
Public Meeting with NEI and Industry “An Optional, Risk-Informed Approach For Resolution of the PWR Sump Blockage Issue (GSI-191)”



Presenters:

Mark G. Kowal, 301-415-1663
Donald Harrison, 301-415-3587

Rockville, MD
June 17, 2004

Purpose of Meeting

- Continue discussions between the staff, NEI and industry regarding a risk-informed option for resolving GSI-191
 - Discuss proposed methodologies and approaches
 - Provide feedback to NEI regarding their proposals from the May 25, 2004 public meeting
 - Discuss the path forward for a risk-informed approach
 - Discuss schedule and milestones
 - Obtain stakeholder comments

Milestones

- Brief ACRS Thermal-Hydraulic Subcommittee - June 22 -23, 2004
- NEI Evaluation Guidelines Chapter 6 submittal - June 30, 2004
- SECY Information Paper to Commision - July 2004
- Draft SER prepared - August 1, 2004
- Brief ACRS Thermal-Hydraulic Subcommittee - August 17, 2004
- Final Draft SER prepared - August 31, 2004
- Brief ACRS Full Committee - September 8 - 10, 2004
- Brief CRGR - September 14, 2004
- Issue Final SER - September 30, 2004

Possible Risk-Informed Approach

- NRC Staff could consider a risk-informed exemption process:
 - Plant-Specific risk-informed exemptions in accordance with 10 CFR 50.12
 - Exemptions from 10 CFR 50.46 (c)(1) - design-basis loss-of-coolant accident equivalent in size to a double-ended guillotine break of the largest pipe in the reactor coolant system
 - Exemption applies only for demonstrating that the requirements of 10 CFR 50.46 (b)(5) are satisfied - Debris generation for Long Term Cooling
- Technical basis
 - In accordance with Regulatory Guide 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” and NUREG-0800, Standard Review Plan Chapter 19
 - Design-basis, deterministic analyses necessary to verify compliance with 10 CFR 50.46 (b)(5) for break sizes up through a “debris generation” break size that may be less than a double-ended guillotine break of the largest pipe in the reactor coolant system

Possible Risk-Informed Approach

- Technical basis (continued)

- Ensure mitigative capability for breaks larger than the “debris generation” break size up through the double-ended guillotine break of the largest pipe in the reactor coolant system:
 - Breaks within this range remain within the design basis
 - Define and satisfy acceptance criteria
 - Functional reliability of necessary equipment
 - Overly conservative, design-basis assumptions would not be necessary
 - Equipment necessary to mitigate may not need to be safety related or single failure proof

- NEI Evaluation Guidelines

- Process and approach would be included in industry evaluation guidelines
- Evaluation guidelines would include a ‘template’ for licensees to follow
- Approach would be considered by the staff as part of evaluation guidelines safety evaluation report
- NRC staff would review plant-specific exemption requests

“Debris Generation” Break Size Selection

- Break size selection for design-basis and ‘realistic’ analyses for debris generation (application to 10 CFR 50.46 (b)(5) only)
 - NOT REDEFINING THE DESIGN-BASIS LOSS-OF-COOLANT-ACCIDENT BREAK SIZE
 - All PWR reactor coolant system auxiliary piping up to and including a double-ended guillotine break of any of these lines -design basis rules apply
 - Reactor coolant system main loop piping (hot, cold and crossover piping) up to a size equivalent to the area of a double-ended guillotine break of the plant’s largest auxiliary piping - design basis rules apply
 - Breaks in the reactor coolant system main loop piping (hot, cold and crossover piping) greater than the above size, and up to the double-ended rupture of the largest pipe in the reactor coolant system - ensure mitigative capability for these breaks
- Basis
 - Double-ended guillotine breaks in auxiliary piping cannot currently be ruled-out
 - Recognizes that double-ended guillotine breaks are less likely in more robust reactor coolant system main loop piping

Risk-Informed Approach Used to Evaluate Acceptability

- Demonstrate Regulatory Guide 1.174 acceptance guidelines are satisfied for full range of break sizes (up through DEGB of largest pipe in the RCS)
 - Change in core damage frequency and large early release fraction calculations
 - Defense-in-depth
 - Safety margins
- Change in risk calculation between current sump conditions (with credit for modifications and/or crediting non-safety equipment) versus sump performance under intended design capability
- PRA quality requirements
- LBLOCA Frequency considerations
- Condition the exemption - licensee must validate results bound the final expert elicitation results

Break Location Considerations NEI Proposal

- For breaks larger than the “debris generation break size” NEI Proposes to use only main RCS loop piping break locations identified using:
 - SRP 3.6.2, “Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping.”
 - Branch Technical Position MEB 3.1, “Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment.”
- Debris generation analyses would not necessarily consider DEGB at these locations because of pipe restraints located at these locations
- “Mitigation not demonstrated” portion of NEI’s block diagram includes unlikely break sizes occurring at unlikely break location

Break Location Considerations

NRC Staff Position

- NRC rejected similar BWROG proposal (staff SER on BWROG URG) - inappropriate to cite SRP 3.6.2 as a basis for determining pipe break locations to demonstrate compliance with 10 CFR 50.46:
 - “SRP Section 3.6.2 does not provide guidance or acceptance criteria for demonstrating compliance with 10 CFR 50.46”
 - “The BWROG has not demonstrated that break locations selected consistent with SRP Section 3.6.2 would bound the worst-case debris generation scenarios and, therefore, meet the intent of 10 CFR 50.46”
- Regulatory Guide 1.82, Rev. 3 suggests that a sufficient number of break locations be considered to “reasonably bound” variations in debris generation by size, quantity and type:
 - Largest amount of potential debris generation within the ZOI
 - Most variety of debris types
 - Areas with the most direct path to the sump

Break Location Considerations

NRC Staff Position

- Regulatory Guide 1.82 suggests that a sufficient number of break locations be considered to “reasonably bound” variations in debris generation by size, quantity and type: (Continued)
 - Medium and large breaks with the largest potential particulate debris to insulation ratio by weight
 - Breaks that generate an amount of fibrous debris that, after transport to the sump, create a uniform thin bed that could filter particulate debris and substantially increase head-loss (thin bed effect)
 - 10 CFR 50.46 rulemaking on path to require demonstrated mitigative capability up through a DEGB of the largest piping in the RCS, independent of break location - not planning to identify specific break locations
 - Staff Position - for breaks larger than the “debris generation” break size, a risk-informed approach to resolve GSI-191 should require demonstrated mitigative capability up through the DEGB of the largest pipe in the RCS, considering break locations which result in the worst-case scenarios for ECCS Sump recirculation capability
-

Exemption Request

- NEI proposed a method which would not require an exemption request
 - Proposal involving license amendment requests and 10 CFR 50.59
 - NEI has submitted a white paper discussing this proposal (ADAMS Accession No. ML041660350)
 - Staff is currently evaluating this proposal

Risk Calculations

- NEI proposes “qualitative risk arguments”
- Staff recommends an approach consistent with Regulatory Guide 1.174
 - Regulatory Guide 1.174 provides methods acceptable to the staff for risk-informed licensing changes, and includes demonstrating that change in risk is small (CDF and LERF)
- Staff position - would not consider a qualitative risk argument:
 - Would require an appropriate level of quantitative analysis to demonstrate that any change in risk would be small, and within the acceptance guidelines of Regulatory Guide 1.174

Discussion Items

- Mitigative Capability Analyses
 - Define analyses to be performed
 - Assumptions
 - Relaxation of conservatisms
 - Treatment of equipment needed to mitigate
 - Acceptance criteria
- NEI Evaluation Guidelines - Chapter 6 contents
 - Regulatory process requirements template
 - Exemption requests, license amendment requests, 10 CFR 50.59 changes
 - Plant-specific submittal package and documentation requirements
 - Technical justification requirements template
 - Elements of Regulatory Guide 1.174 (Defense-in-depth, safety margins, risk calculations)
 - “Debris generation” break size selection
 - Risk calculations and results
 - Design basis analyses
 - Mitigative capability analyses

Discussion Items (Cont.)

- NEI White Paper (ADAMS Accession No. ML041660350)
- Actions needed to meet the schedule